

Speed and Acceleration Monitor Formulas and Sample Data

Label	Length (inches)
d	70

Label	uSec	Event
T1 (t1a) beam	0.000000	Front wheel breaks entrance laser
T2 (t1b) beam	0.070110	Front wheel leaves entrance laser
T3 (t2a)	0.194123	Front wheel breaks exit laser beam
T4 (t2b)	0.262409	Front wheel leaves exit laser beam
T5 (t3a)	0.308330	Rear wheel breaks entrance laser beam
T6 (t3b)	0.378142	Rear wheel leaves entrance laser beam
T7 (t4a)	0.499250	Rear wheel breaks exit laser beam
T8 (t4b)	0.567303	Rear wheel leaves exit laser beam

$$\begin{aligned} S1a &= 70 / ((t2a - t1a) * (3600 / (5230 * 12))) = 20.43739 \\ S1b &= 70 / ((t2b - t1b) * (3600 / (5230 * 12))) = 20.63275 \\ S2a &= 70 / ((t4a - t3a) * (3600 / (5230 * 12))) = 20.83634 \\ S2b &= 70 / ((t4b - t3b) * (3600 / (5230 * 12))) = 21.00310 \\ \text{Delta } T_a &= ((t3a - t1a) + (t4a - t2a)) / 2 = 0.30698 \\ \text{Delta } T_b &= ((t3b - t1b) + (t4b - t2b)) / 2 = 0.30657 \\ \text{Delta } V_a &= S2a - S1a = 0.39896 \\ \text{Delta } V_b &= S2b - S1b = 0.32035 \\ \text{Speed}_a &= (S2a + S1a) / 2 = 20.53737 \\ \text{Speed}_b &= (S2b + S1b) / 2 = 20.84293 \\ S &= \text{Speed}_a + \text{Speed}_b / 2 = 20.76515 \\ \text{Accel}_a &= \text{Delta } V_a / \text{Delta } T_a = 1.299631 \\ \text{Accel}_b &= \text{Delta } V_b / \text{Delta } T_b = 1.044949 \\ A &= (\text{Accel}_a + \text{Accel}_b) / 2 = 1.17729 \end{aligned}$$

Thus, there has been described a method and apparatus for obtaining the speed and acceleration of a motor vehicle having many advantages. While the invention has been described in connection with preferred and illustrative embodiments, it should be understood that variations will occur to those skilled in the art, and the invention is to be limited only by the claims appended hereto and equivalents.

1. Apparatus for determining speed and acceleration of a motor vehicle traveling on a roadway comprising:

1. Apparatus for determining speed and acceleration of a motor vehicle traveling on a roadway comprising:
- a first radiation source producing a visible entrance laser beam and arranged at one side of the roadway;
 - a first detector arranged at an opposite side of the roadway to receive said visible entrance laser beam from said first radiation source for producing an output signal indicating a presence or absence of the visible entrance laser beam;
 - a second radiation source producing a visible exit laser beam and arranged at said one side of the roadway and being spaced apart by a predetermined distance from said first radiation source;
 - a second detector arranged at said opposite side of the roadway to receive said visible exit laser beam from said second radiation source for producing an output signal indicating the presence or absence of the visible exit laser beam;
- wherein front and rear wheels of the motor vehicle each interrupt said visible entrance laser beam and said visible exit laser beam and the interruptions are detected by said first and second detectors; and

analyzing means receiving said output signals from said first and second detectors for calculating the speed and acceleration of the motor vehicle.

2. The apparatus according to claim 1 wherein the analyzing means further comprises:

timing means for measuring time;

determining means for producing a pulse when said front wheel and rear wheel passes into and departs from said visible entrance laser beam and said visible exit laser beam, respectively;

memory means for storing each measured time when said determining means produces said pulse indicating that said front and rear wheels passed into and out of said visible entrance laser beam and said visible exit laser beam, respectively; and

calculating means for calculating said speed and acceleration using said predetermined distance and each of said measured times recorded by said recording means.

3. The apparatus according to claim 2 further comprising:

vehicle emissions testing means receiving said calculated speed and acceleration from said analyzing means for obtaining exhaust emissions data from the motor vehicle; and

display means for displaying said speed and acceleration calculated by said analyzing means.

4. The apparatus according to claim 2 wherein said predetermined distance is substantially equal to 70 inches.

5. The apparatus according to claim 2 wherein said visible entrance laser beam and said visible exit laser beam are unmodulated.

6. The apparatus according to claim 2 wherein said first detector and said second detector include a photo transistor having a lens and a bandpass filter.

7. A method for determining speed and acceleration of a motor vehicle traveling on a roadway comprising the steps of:

producing a plurality of visible laser beams spaced apart by a predetermined distance and directed across the roadway;

arranging the plurality of visible laser beams at a height to be interrupted by front and rear wheels of the motor vehicle;

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determining when the front and rear wheels pass into and out of each of said plurality of visible lasers beams;
producing a time measurement at each determined occurrence;
recording each of said time measurements when the front and rear wheels pass into and out of each of said plurality of visible laser beams, respectively; and
calculating a speed value and an acceleration value from said fixed distance and each of the time measurements recorded in said step of recording.

8. A method according to claim 7, further comprising the steps of:

obtaining exhaust emissions data from the motor vehicle;
and

displaying the calculated speed value and the calculated acceleration value.

9. Apparatus for detecting acceleration of a motor vehicle passing along a roadway comprising:

means for producing first and second visible laser beams spaced apart by a predetermined distance on one side of the roadway and arranged at a height above the roadway so as each to be interrupted by a front wheel and a rear wheel of the motor vehicle;

detector means arranged at a side of the roadway opposite said one side for receiving said first and second visible laser beams and producing respective output signals indicating interruptions of said first and second visible laser beams by the front and rear wheels of the motor vehicle;

measuring means for receiving said output signals from said detector means for producing time measurements at each occurrence of said interruptions of said first and second visible laser beams and for producing time measurements at each resumption of each interrupted first and second visible laser beams; and

calculating means receiving said time measurements from said measuring means for calculating an acceleration of the motor vehicle based on said predetermined distance.